

## TECHNIQUES OF URBAN TRANSPORTATION STUDIES

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Ladies and gentlemen, it's with pleasure that I come before you this morning to speak on the subject of Urban Transportation Planning and some of the current techniques which are being employed in the prosecution of these plans in various communities throughout the country. I appreciate being here because it gives me the opportunity to discuss with you, many of whom are administrators and legislators in your own communities, the real values which are to be gained from urban transportation studies. I know that to many, the idea of an urban transportation plan brings to mind first, the cost of carrying out such a study, and secondly, that such a study may provide the justification for a particular pet project of the community. That these two thoughts should be foremost in the minds of those charged with the responsibility of initiating urban transportation studies is not unusual and should not, I believe, be criticized. If, however, we only think to this depth, we do not really recognize the true values to be gained.



The day is past when an engineer can confine his interests and thoughts only to a highway's physical aspects. It must be realized that the end objective is not to build roads or other transportation facilities, but to serve people, and only through the many and varied studies involved in an urban transportation study can this service be obtained. To serve people, to eliminate traffic congestion and accidents, and to insure that urban arterial highway plans promote a community's urban area development are the essential features of an urban transportation plan. Before I talk of the specific features and techniques of urban transportation planning, I would like to quickly outline six basic principles which are inherent in such planning.

1. *Transportation planning in an urban area must include study of the entire urban area* without omitting particular segments or municipalities just because they are separated from the core city by governmental or topographic boundaries. Transportation problems do not stop at city limits, and neither should the planning stop there.
2. *The development of a regional transportation plan is principally a local area responsibility.* I recognize, of course, the interests of the agencies of the Federal and State governments which have transportation and general planning responsibilities on a broad scale. I appreciate and recognize the value of incorporating these agencies and their thinking in the development of the planning program. I am sure, however, that both the State Highway Department and the Bureau of Public Roads would agree that without the cooperation and participation of local people, transportation studies will not and cannot provide the framework for a future action program.

3. *Transportation planning must be coordinated with other planning activities in the area.* A good transportation planning program will ask two questions. First, what kind of an area is desired for the future. Secondly, what can planned transportation do to assist the area in realizing its desires. It has been said that transportation not only serves, but also shapes, the urban area. We should recognize that transportation has to be worked in conjunction with the planned development of community facilities, urban renewal, sewage treatment, utility extensions, schools, and all other segments of urban area development. Planners, administrators, and transportation engineers and others must pool their talents to obtain full benefits of the program.
4. *Good, current analytical techniques and procedures are essential to a good transportation planning program.* This, of course, is the basic subject of my talk today, and so I will discuss this in more detail subsequently.
5. *A transportation planning program must be a continuing one.* Initial studies vary from six months to three years depending upon the size of the community. However, transportation planning is affected by changes in land development, re-oriented goals of the community, and flexible financing structures which often result in changing conditions, thereby varying the transportation requirements of the community. This means that the initial study normally sets the basic outline and specifies those facilities which are necessary in light of the assumptions made at the time of the study and which are within the general capabilities of the community to provide in a reasonable period of years. As modifications occur in any one of the three items mentioned above, it may be necessary or expedient to change or modify the transportation planning program after the initial plan has been developed. It should be the purpose of a transportation planning program to recognize the continuing nature of transportation planning. Data gathering and recording should be in a format easily updated and revised. Handling by mechanical means is desirable in any urban area. Forecasting techniques must be adaptable to the addition of new information and to re-evaluation of the revised picture as changes occur. Not only does a continuing process assure a better transportation program, but it can serve other important functions. It can continue to provide information of value to other planning processes in the area. It can serve to present a current picture to legislative and administrative officials on whose shoulders rests the ultimate responsibility for implementation. The procedures developed for the study can also be used during or before construction of various facilities to anticipate and solve temporary problems resulting from that construction.
6. *The preparation of a transportation plan must have effective public relations support and participation.* This, as I will discuss subsequently, is, I believe, the real key to transportation planning.

These six basic principles for the development of an urban transportation plan are, of course, not original with me. They are the basic ideas upon which the guide books developed by the National Committee on Urban Transportation were founded. They are the stated principles of the Bureau of Public Roads in their various technical memoranda on transportation planning and they are also the inherent precepts which general planners follow in their studies for the development of an urban area. That they are accepted as being universal precepts for formulating a plan does not, however, mean that they should not be repeated. All too often we are ready to concentrate on the specific before we have determined what the generalized plan of procedure will be and what the basic techniques are which will tie the study together. I would like to ask that you keep in mind these six principles—*study of the entire urban area, development of regional transportation as a local area responsibility, transportation planning as a coordinated function with other planning activities in the area, analytical tech-*

*niques and procedures which are of the highest technical competence, transportation planning as a continuing program, and, finally, transportation planning as a function with effective public relations support and participation.*

Since I am to talk this morning about techniques of urban transportation planning, I would like to begin that portion of the discussion with a few comments on organization. Organizing a planning program for transportation is probably the most difficult and yet the most critical part of the program. With the organization phase rests the ultimate success of the program. It is here that the responsibility for the actual work is allocated, coordination is established between the multitude of agencies, bureaus and organizations to provide the necessary information, and public support is established for both the planning process and the ultimate development plan. This stage involves three items, namely,

1. *Obtaining legislative approval.* This approval should have the force of a legislative mandate providing for participation and cooperation of all agencies involved. Procuring and budgeting of funds for the program is another important phase of this item.
2. *Establishing technical coordination.* Organization for the technical aspects of program must be established in the beginning of the program. Who is going to furnish or collect the land use data? Who is going to do the origin-destination surveys? Are all of the communities within the urban area going to be represented on the technical committee? Is the activity of all the members of the technical committee going to be active or, in some instances, passive? What is the tone of the study to be? Is it to be basically an engineering study? Or, on the other hand, is it to be a planning study? How detailed are the inventories to be? What inventories are to be made? Is mass transit to have a part in the urban transportation study? How are decisions going to be made, between and among the several agencies involved? Who is going to have the technical responsibility for directing the study? For what period of time shall the study be established? These are just a few of the many important questions that have to be answered in the organizational phase of the study. I believe that experience has shown that the best procedure to be followed is to assign or hire some individual or group during the initial stages of discussing the study, whose responsibility it is to develop a manual of procedure for the entire study program. This manual of procedure should include general operational techniques, man-hour and cost estimates, assignments of responsibility, schedules for completion by phases, and indication of the method of presentation and dissemination of findings to the technical committees and to the public. Following the completion of the outline of procedure in a preliminary fashion, the various agencies who will make up the transportation planning program committee can meet and discuss the emphasis which the procedure manual has established. After proper discussion and re-writing which is always a part of this phase, the transportation planning program is technically ready to begin.
3. *Develop public support.* The final item under organization is the development of a public relations program which moves in conjunction with the transportation planning program. This is an exceptionally important item and should be given careful consideration. The degree of understanding which the administrators and technical committee of an urban area imparts to the local citizens will have an important bearing on the successful adoption and implementation of the recommended plan.

Public support can be obtained by means of a citizens committee drawn from various organizations and groups who are periodically brief on the aims, objectives, and progress of the study, and who are allowed to assist wherever possible in productive capacities.



Inclusion of and briefings for the various news media in the area should be assigned top priority. In the Dayton Regional Transportation Study, a number of noteworthy actions in this field were taken. The news media were invited to all regular technical and steering committee meetings. News releases and copies of various interim reports were sent to them when specific plateaus in the study were reached. Meetings were held with these people at frequent intervals so that they were fully acquainted with the purposes and progress of the transportation study.

In the area of civic responsibility, the Dayton Regional Transportation Committee was instrumental in bringing together a group of men within the community who formed the Citizens Regional Transportation Board, whose responsibility it is to act as a sounding board for the Regional Transportation Committee. Acting in this function they carry the information developed by the Regional Transportation Committee to the people of the community and, in turn, accumulate the responses of the area's citizens and transmit those feelings back to the Regional Transportation Committee. In January of this year, it was the Citizens Regional Transportation Board who were instrumental in sponsoring the Growth and Change Workshop which brought together, in Dayton, such outstanding people in the field of general planning and transportation as Senator Harrison Williams of New Jersey, Mr. David Loeks of the Twin Cities Metropolitan Planning Commission, Mr. William Finley of the National Capitol Planning Commission, Mr. John Kohl, Assistant Administrator for Urban Transportation, Office of the Transportation Agency of the House and Home Finance Agency, and Mr. Harold Wise, Consultant to the Philadelphia Industrial Development Corporation.

Another phase of this item of developing public support is the action of the Regional Transportation Committee in Dayton to emphasize the development during the study, of visual presentations. These presentations included large-size land use maps, slides and models which were used at numerous meetings, fairs, and other functions where large groups of people were accumulated.

These are just a few of the techniques which are possible and which have been used to develop public support during the development of transportation plans. Whatever actions have been taken to date in Dayton and other studies are, regardless of their scope, normally still insufficient. To a small group of informed people in Dayton, the objectives of the study, the findings of the analysis, and the reasons for the recommendations are beginning to make sense. This, I believe, is what a public information and participation program must do.

You may feel that I have dwelt for some length on organization and feel to a degree that this is not really a technique of urban transportation planning. I assure you that it *is* a technique which *does* require considerable thought and action. Why is it so necessary? Such concern was never given previously to individual highway projects although there has been concern about these individual highway projects. I believe for the answer we should go back to the six basic principles which I enumerated to you, and see how many of these principles were seriously considered ten years ago. In most of our major planning for our urban areas we are beginning to do a pretty good job of convincing ourselves on the validity of these points. The purpose of a public information program is to bring the same realization to the other members of our communities.

Now, while I have a few minutes left, I would like to talk about some of the technical aspects of urban transportation planning. In late 1957 I had the opportunity to be in Washington to listen to two men from the Bureau of Public Roads and one from the Washington, D. C. Highway Department discuss the outline of the traffic assignment program with one of our large computer companies. The purpose of this meeting was to develop the ground rules for writing a program which would assign traffic to street networks within an urban community. The core of this program was a routine which finds the minimum

time path from one point in the system to all other points within that system. On these minimum time paths it was intended to load the origin-destination survey information expanded to some future year to find how much traffic would be going from various points in the urban area to other points, how much traffic would be on any particular street within the urban area, and many other relationships concerning traffic in the urban area which had been very crudely determined up to that time. The contract based on the outline for the program was ultimately given to General Electric in Phoenix. The first phases of the program were completed in early 1958. It was my fortunate experience to have the opportunity to make the first runs on nine system networks for Charleston, West Virginia in March 1958. At the same time, a comparable program for a large-scale electronic computer was being developed by the Chicago Area Transportation Study.

Since 1958, four years ago next month, urban transportation has turned the corner. For it is because of the development of sophisticated traffic programs on *large-scale* electronic computers that the dramatic progress in transportation planning has been possible. Because of this progress, first major cities, then smaller cities have begun to see a means by which they can evaluate accurately their transportation system. They have seen a means by which they can review alternative ideas to obtain a more objective answer. As of this date, the Washington, D. C. group has made over fifty assignments for their area to decide such problems as ramp configuration on interchanges, lane widths, construction staging, classical cost benefit analysis, required development of access roads to the interchanges, and many, many other questions.

Since the early efforts in 1958, there have been additional major programming efforts in the transportation field. Some of the more notable of these is the work on the gravity model by Mr. Alan Voorhees and Mr. Walter Hansen and the opportunity model of the Chicago Area Transportation Study. This procedure will, when more study and analysis of existing data has been performed, permit the synthesizing of origin-destination survey data with a greatly reduced amount of field work resulting in considerably less cost and considerably more flexibility for analysis.

The Bureau of Public Roads, the Toronto Metropolitan Planning Commission, and the Chicago Area Transportation Study have been active in developing programs which relate the capacity of the streets in the system to the desire of the traffic moving from zone to zones to use those streets.

Studies in Hartford, Dayton, and other areas have attempted to determine what relationships existed between various features of the urban area such as availability of water, sewers, accessibility of one point to all others in the urban area, proximity to certain types of development, cost of land, prestige areas and the like have on the location of new population and the relocation of old population within the urban area.

Various studies are currently investigating the factors which affect the relative usage of mass transit and the automobile depending on income class, automobile ownership, orientations of the central business district, travel time, distance to the bus stop at the terminal ends, and numerous other factors.

Procedures are under development for detailed and meaningful analysis of the user costs based on the entire system approach.

Rapid progress is being made in the development of programs which will synthesize traffic on ramps and expressways so that more finite values concerning capacity of these facilities can be determined when such variables as approach speeds, number of vehicles, width of the control section, percentage of trucks, and other features are considered.

These are just some of the many advancements which have come about in the last few years because of the development and use of the large-scale electronic computers. Please don't think, however, that I'm stating that the use of the electronic computer is the transportation planning program. Nothing could be

further from the truth. What I am stating is that the large-scale electronic computer has opened up new horizons in the development of transportation planning with the result that city after city throughout the country is considering and in many instances working towards the development of a transportation planning program. The computer has permitted this type of study. It is the core of the study. Good organization, sound judgment, technically competent people, and a cooperative effort must occupy an important place in the studies. Transportation planning is, I feel, a real challenge to our communities. It offers the opportunity of bringing together diverse talents of the professional and civic people within the community and weld them together with a reasonable balance between subjective and objective analysis.

The transportation planning program with the electronic computer at its core has put an increased emphasis on the value and responsibilities of objective analysis. The net effect has been, I believe, to bring a great understanding between planners, engineers, and administrators.

In the Dayton study, we outlined a general procedure for the evaluation of alternative Transportation Improvement Programs which provides an understanding of the process which is involved in urban transportation planning. From that outline you will be able to see how closely the various technical groups and technical members of the study must cooperate to develop recommendations which are compatible with the facts. Following is the required input for the evaluation of the alternative Transportation Improvement Programs:

1. The existing transportation system, which includes travel times capacity, etc.
2. Existing population distribution and 1970 total population.
3. Ten-year population distribution equations.
4. Estimated 1970 trip generation rates.
5. Estimated 1970 trip distribution factors.
6. Estimated 1970 employment distribution.

The following is the process for evaluation of the alternate Transportation Improvement Programs:

Part I: Develop the generalized 1970 land use plan.

Part II: Develop the 1970 origin-destination pattern of trips.

Part III: Develop alternative 1960 to 1970 Transportation Improvement Programs.

Part IV: Evaluate alternative 1960 to 1970 Transportation Improvement Programs.

Part V: Repeat Parts I through IV, using input data updated ten years to develop 1970 to 1980 Transportation Improvement Programs and evaluate same.

Part VI: Repeat Parts I to IV, using input data updated twenty years to develop 1980 to 1990 Transportation Improvement Programs and evaluate same.

That constitutes the general outline for evaluating alternative Transportation Improvement Programs. Now I would like to list in outline form a breakdown of the various parts of the process listed above. This breakdown is as follows:

Part I: To develop 1970 generalized land use plan.

Step 1: Using as input the 1960 transportation system, the 1960 population distribution, the 1970 total population, and the ten-year population distribution equations, develop estimated 1970 population distribution.

Step 2: Check against holding capacities and adjust.

Step 3: Itemize known alterations in land use caused by public action.

Step 4: Estimate 1970 employment distribution using Steps 1 through 3 above, economic indicators, known alterations in land use caused by private actions.



Part II: To develop 1970 O-D pattern.

- Step 1: Using 1970 population distribution and input and estimated 1970 trip generation rates, estimate 1970 trip production for each zone.
- Step 2: Using 1970 employment distribution and estimated 1970 trip generation rates, estimate 1970 trip attractions for each zone.
- Step 3: Using estimated 1970 trip distribution factors determine trip distribution from known trip ends.
- Step 4: Prepare 1970 origin-destination table from trip distribution.
- Step 5: Determine model split from origin-destination tables and relevant characteristics of origin-destination zones.

Part III. To develop alternative 1960 to 1970 Transportation Improvement Programs.

- Step 1: Translate existing transportation system into link node data for route assignment program.
- Step 2: Load 1970 origin-destination table into route assignment program.
- Step 3: Examine route assignment output and identify overload conditions (prepare demand over capacity ratios.)
- Step 4: Outline possible useful projects including estimated costs, centerlines, interchange locations or other applicable characteristics for transit.
- Step 5: Assume levels of annual expenditures, for instance, \$15,000,000, \$30,000,000 and \$45,000,000. Outline several integrated Transportation Improvement Programs for each. Each Transportation Improvement Program must be realizable but must differ from the others in concept, geographic orientation or total cost.

Part IV: To evaluate alternative 1960 to 1970 Transportation Improvement Programs.

- Step 1: Translate alternate 1960 to 1970 Transportation Improvement Programs into link node data for route assignment program.
- Step 2: Load 1970 origin-destination table into each complete system. Accumulate the following for each:
  - a. Total overcapacity vehicle miles
  - b. Total vehicle miles on improved facilities.
  - c. Regional accident rate per million vehicle miles.
  - d. Cost benefit ratio for complete system.
- Step 3: Develop standard criteria and evaluate alternative Transportation Improvement Programs.
- Step 4: Adjust Transportation Improvement Programs to optimize benefits.
- Step 5: Screen out lowest ranking Transportation Improvement Programs. Review highest ranking Transportation Improvement Programs.

Part V: To develop and evaluate alternative 1970 to 1980 Transportation Improvement Programs. Repeat Parts I through IV, using revised input data as follows:

- 1. 1970 transportation system (using one or more high-ranking Transportation Improvement Programs).
- 2. 1970 transportation distribution and 1980 total population.
- 3. Ten-year population distribution equations.
- 4. Estimated 1980 trip generation rates.
- 5. Estimated 1980 trip distribution factors.
- 6. Estimated 1980 employment distribution.

Part VI: To develop and evaluate alternative 1980 and 1990 Transportation Improvement Programs. This is done by repeating Parts I through IV above, using output data of Part V as input.

This outline describes a technique which recognizes the interrelationship between transportation and community development. Subsequent to this, I have described some of the techniques concerning the relationship between the technical members of the study and the civic leaders. We have also discussed some of the broad techniques and principles which have to be recognized in a study of this sort. If I have been able to leave you with an understanding of the value of urban transportation planning, and have given you some insight into the methods which are employed, I will feel that the time has been worthwhile. Three short points before I close.

1. Don't feel that urban transportation planning programs are just for the large cities. The manual of procedure is, of course, less detail for the smaller cities. The problems aren't quite so big. Technical and civic values in proportion are every bit as great.
2. Don't be overwhelmed by the technical complexities of the electronic computer and other analytical phases of the study. Ask questions and learn.
3. Even if you hire outside professional help, and in many cases this will be necessary, be sure to have some of your local people directly and definitely involved in the study. If you do this, you can develop a plan for action, and not for show.